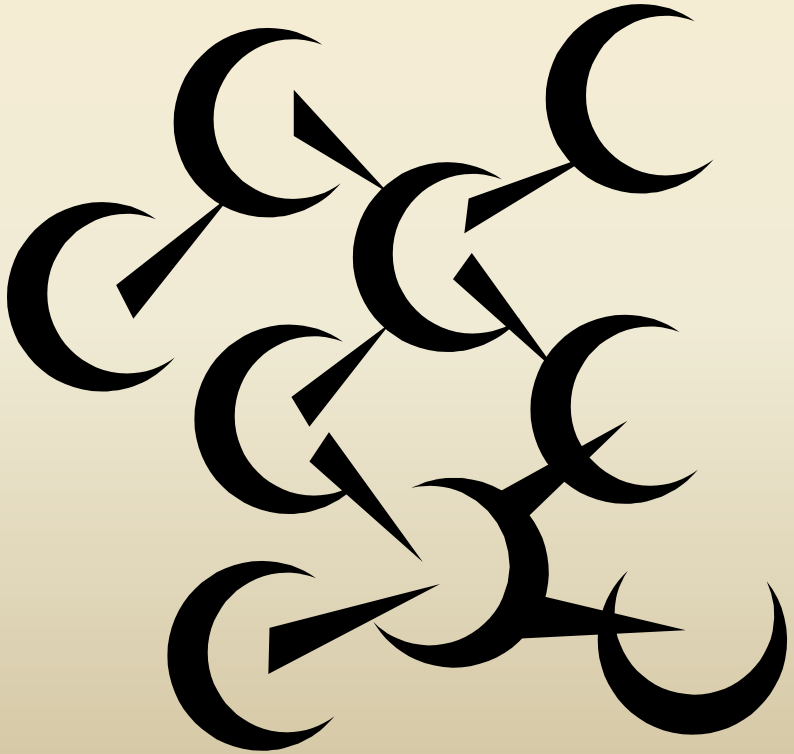
Unit 7 - Matter

Chapter 2 & 3

Chemistry

- Is the study of what things are made of and how things change.



Matter

- Anything that has mass and takes up space.
- Matter is made up of atoms
- Light, sound and electricity are NOT matter

Classifying Matter

Pure Substance

- Pure substance is matter that always has exactly the same composition, or simply a substance
- Examples of pure substances: salt and sugar
- **Every sample of a given substance has the same properties because a substance has a fixed, uniform composition**
- Substances can be classified into two categories – elements and compounds

Elements

- Element is a substance that cannot be broken down into simpler substances
- Atom is the smallest particle of an element
- **An element has a fixed composition because it contains only one type of atom**

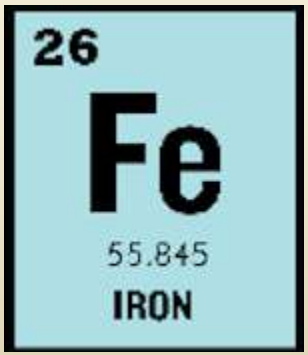
Elements

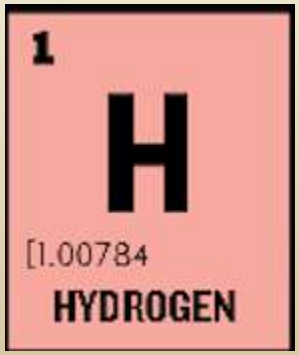
1. Examples of Elements

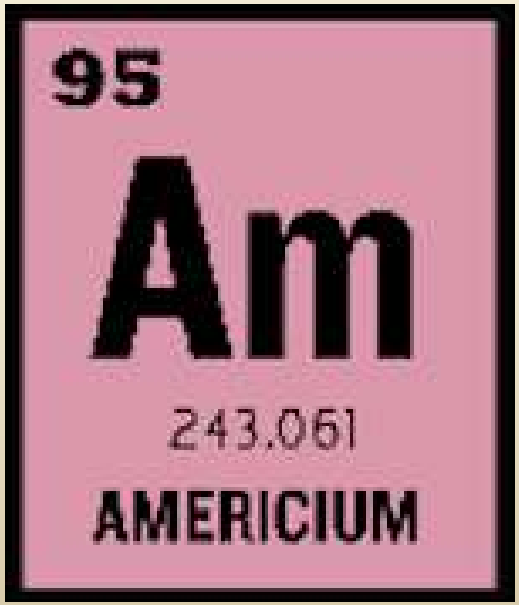
- At room temperature most elements are solids
- Carbon is the main element in the marks you make with a pencil on a piece of paper
- Some elements are gases at room temperature: oxygen and nitrogen
- ONLY two elements are liquids at room temperature: bromine and mercury

Symbols for Elements

- 1813 Jons Berzelius suggested that chemist uses symbols to represent elements
- Each symbol has either one or two letters, with the first letter always being capitalized
- Symbols were bases on the Latin names of elements





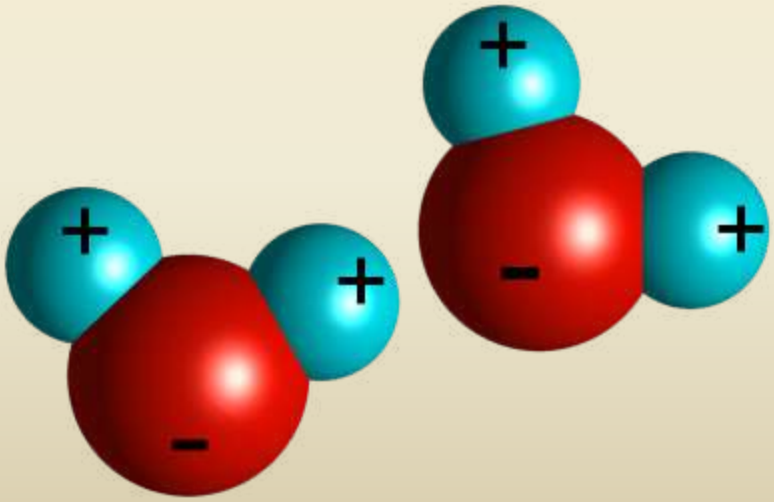


Compounds

- Compound is a substance that is made from two or more simpler substances and can be broken down into those simpler substances.
- the simpler substance are either elements or other compounds
- the properties of a compound differ from those of the substance form which it is made

Compounds

- **a compound always contains two or more elements joined in a fixed proportion**
- example: water has 2 hydrogen for each oxygen.



- Mixtures - A combination of substances that are not fixed;

they can change

OJ – is a mixture of water, citric acid and sugar among other things. Any drop of Orange Juice can have different amounts of the

Mixtures

- mixtures tend to retain some of the properties of their individual substances
- **the properties of a mixture can vary because the composition of a mixture is not fixed**
- mixtures can be classified by how well the parts of the mixture are distributed throughout the mixture.

Types of Mixtures

1. Heterogeneous Mixture
   - look as a hand full of sand forma beach and it all looks the same, but under magnification it is not.
   - Heterogeneous mixture the parts of the mixture are noticeably different from one another.

Types of Mixtures

2. Homogeneous Mixture
   - Homogeneous mixture the substance are so evenly distributed that it is difficult to distinguish one substance in the mixture from another
   - Example: stainless steel which is a mixture of iron, chromium, and nickel

- E. Solutions, Suspensions, and Colloids
  - The size of the particles in a mixture has an effect on the properties of the mixture
  - **Bases on the size of its largest particles, a mixture can be classified as a solution, a suspension, or a colloid.**

1. Solutions

- Placing a spoonful of sugar in a glass of hot water and stirring with dissolve the water and make a homogeneous mixture
- Solution forms when a substance dissolves and from a homogeneous mixture
- Example: Kool-Aid, or tea

2. Suspensions

- Suspension is a heterogeneous mixture that separates into layers over time
- Examples: salad dressing, sand and water.
- Because larger particles can scatter light in all direction suspensions are cloudy

3. Colloids

- Milk is a mixture of substances including water, sugar, proteins and fats
- Colloid contains some particles that are intermediate in size between the small particles in a solution and the larger particles in a suspension
- Colloids do NOT separate into layers
- Fog is a colloid of water droplets in air

Colloids

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_____ is the study of matter and how it changes.

__**CHEMISTRY**_ is the study of matter and how it changes.

Examples of Physical Properties

- Physical property is any characteristic of a material that can be observed or measures without changing the composition of the substances in the material
- **Viscosity, conductivity, malleability, hardness, melting point, boiling point, and density are examples of physical properties**

1. Viscosity

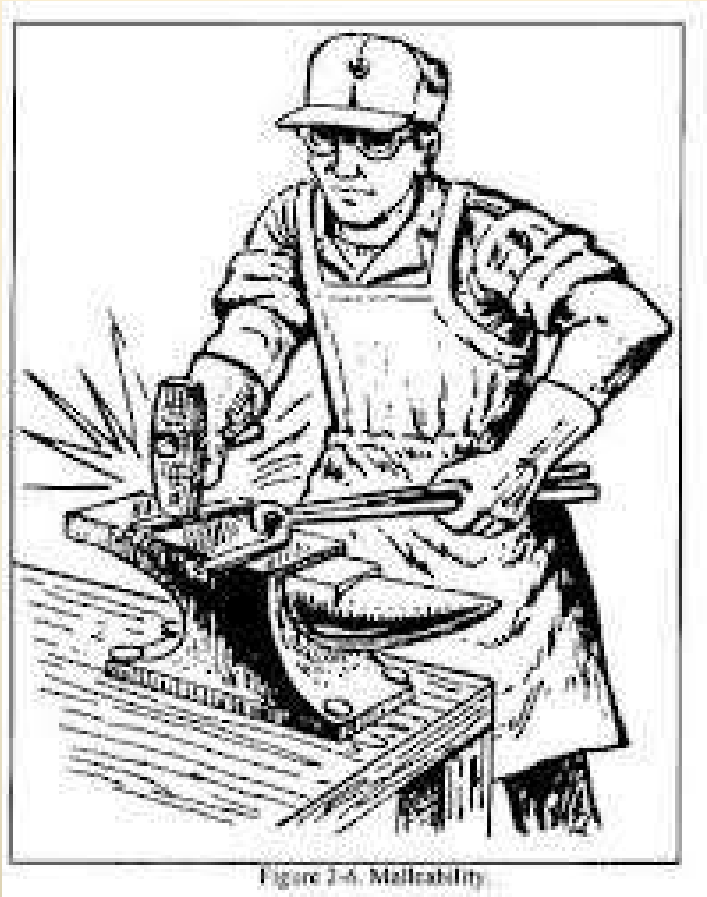
- Viscosity is the tendency of a liquid to keep from flowing (its resistance to flowing)
- the greater the viscosity the slower the liquid moves
- honey and corn syrup have high viscosity and vinegar have low viscosity
- Viscosity will decrease when it is heated

2. Conductivity

- Conductivity is a material's ability to allow heat to flow
- Metals have high conductivity and are conductors
- Wood will not conduct heat and make a great spoon

3. Malleability

- Malleability is the ability of a solid to be hammered in to sheets (or shapes) without shattering
- Most metals are malleable
- Solids that shatter when struck are brittle



4. Hardness

- One way to compare the hardness of two materials is to see which of the materials can scratch the other
- Diamond is the hardest known material

5. Melding and Boiling Points

- Melting point is the temperature at which a substance changes from solid to liquid.
- Melting point for water is 0°C
- Boiling point is the temperature at which a substance boils
- Boiling point of water is 100°C

6. Density

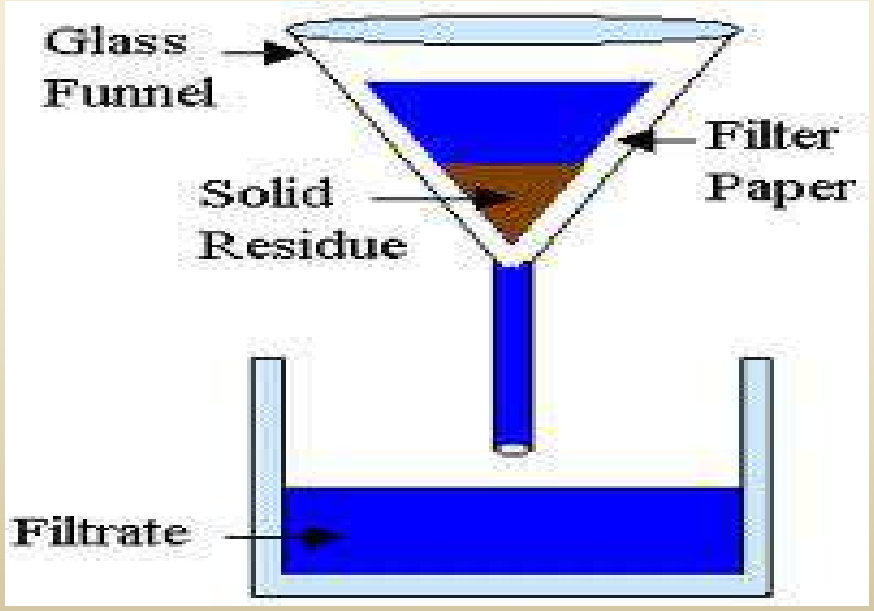
- Recall that density is the ratio of the mass of a substance to its volume
- Density can be used to test the purity of a substance

B. Using Physical Properties

- **Physicals properties are used to identify a material, to choose a material for a specific purpose or to separate the substances in a mixture.**

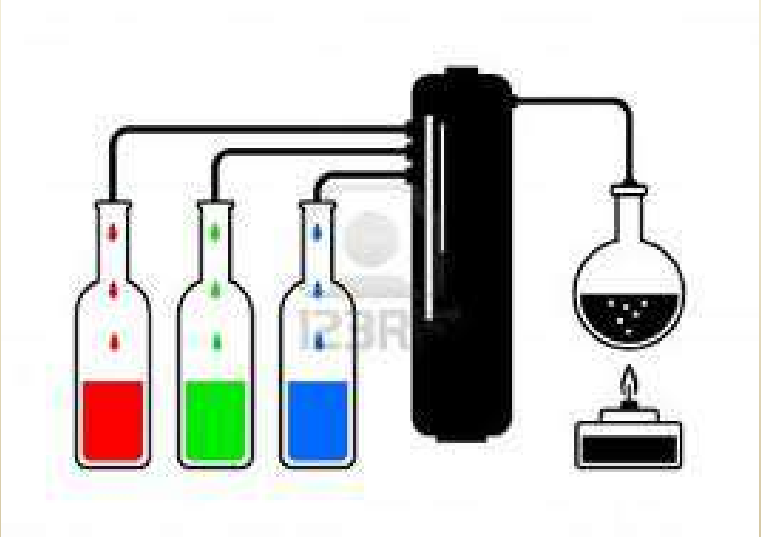
Using Properties to Separate Mixtures

1. Filtration
   - Filtration is a process that separates materials bases on the size of their particles
   - Example: tea leaves caught in a strainer when making tea



Using Properties to Separate Mixtures

2. Distillation
   - Distillation is a process that separates the substances in a solution bases on their boiling points
   - A practical use of distillation is to provide freshwater for submarines



Recognizing Physical Changes

- Physical change occurs when some of the properties of a material change, but the substances in the material remain the same
  - Heating butter until it melts, crumpling a piece of paper, slicing a tomato
  - Some physical changes can be reversed: freezing and melting
  - Some physical changes can NOT be reversed: reforming a whole tomato from its slices

Chemical Properties

- Chemical property is any ability to produce a change in the composition of matter
- **Chemical properties can be observed only when the substances is a sample of matter are changing into different substances**

1. Flammability
   - Flammability is a material's ability to burn in the presence of oxygen
   - Example: burning newspapers to start a fire
2. Reactivity
   - Reactivity describes how readily a substance combines chemically with other substances
   - Oxygen is highly reactive element and reacts easily with most other elements
   - Oxygen reacts with iron and water to form rust
   - Nitrogen has low reactivity and can be used inside tanks to limit rust formation

Recognizing Chemical Changes

- Chemical change occurs when a substance reacts and forms one or more new substances
- **three common types of evidence for a chemical change are a change in color, the production of a gas, and the formation of a precipitate.**

1. A change in Color
   - a change in color is a clue that a chemical change has produced at least one new substance
   - silver that tarnishes over time, copper roof changing from red to green when exposed to water

2. Production of a Gas

– bubbles of gas forming when u mix vinegar and baking soda is a sign that a chemical change occurred

3. Formation of a Precipitate

- precipitate is a solid that forms and separates from a liquid mixture
- adding lemon juice to milk will form some white solid

C. Is a Change Chemical or Physical?

- Ask yourself: are different substances present after the changes takes place
- NO=physical change, yes= chemical change
- **When matter undergoes a chemical change the composition of the matter changes**
- **When mater undergoes a physical change the composition of the matter remains the same.**

Chapter 3

States of Matter

3.1 Solids, Liquids, and Gases

A. Describing the States of Matter

- **Materials can be classified as solids, liquids, or gases based on whether their shapes and volumes are definite or variable**
- **Frequently referred to as the phases of matter or states of matter**

3.1 Solids, Liquids, and Gases

1. Solids

- Solids is the state of matter in which materials have a definite shape and definite volume
- The shape and volume of a solid will NOT change
- Almost all solids have some type of orderly arrangement of particles at the atomic level

States of Matter

2. Liquids

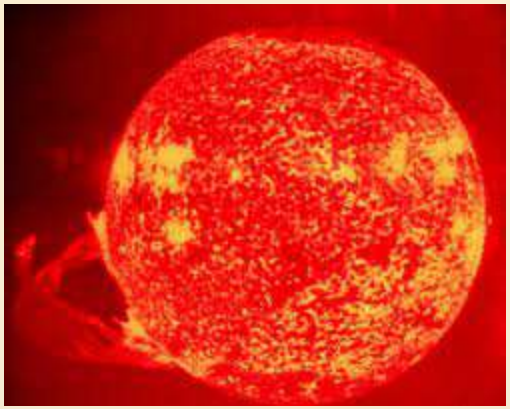
- Liquid is the stage of matter in which a material has a definite volume but not a definite shape
- A liquid always has the same shape as its container and can be poured from one container to another
- The arrangement is more random then in a solid.

States of Matter

3. Gases

- Gas is the state of matter in which a material has indefinite shape and indefinite volume
- A gas takes the shape and volume of its container
- The atoms are not arranged in a regular pattern, and they are at random locations throughout the container

States of Matter



4. Other Stats of Matter

- 99% of all matter in the universe exists in a state that is not as common on Earth
- Plasma is gas-like substance of charged particles; traveling very fast
- Plasmas exist at extremely high temperatures ,such as on the sun or on stars
- plasma is found on earth during lighting.

B. Kinetic Theory

- Kinetic energy is the energy an object has due to its motion
- the faster the object moves the greater its kinetic energy is
- **the kinetic theory of matter says that all particles of matter are in constant motion**
- These tiny particles are always in motion. The higher the temperature, the faster the particles move.
- At the same temperature, more massive (heavier) particles move slower than less massive (lighter) particles.

C. Explaining the Behavior of Gases

- The particles in a gas are never at rest
- Particles in a gas are in constant, random motion
- **The constant motion of particles in a gas allows a gas to fill a container of any shape or size**
- The motion of one particle is unaffected by the motion of other particles unless the particles collide
- Forces of attraction among particles in a gas can be ignored under ordinary conditions

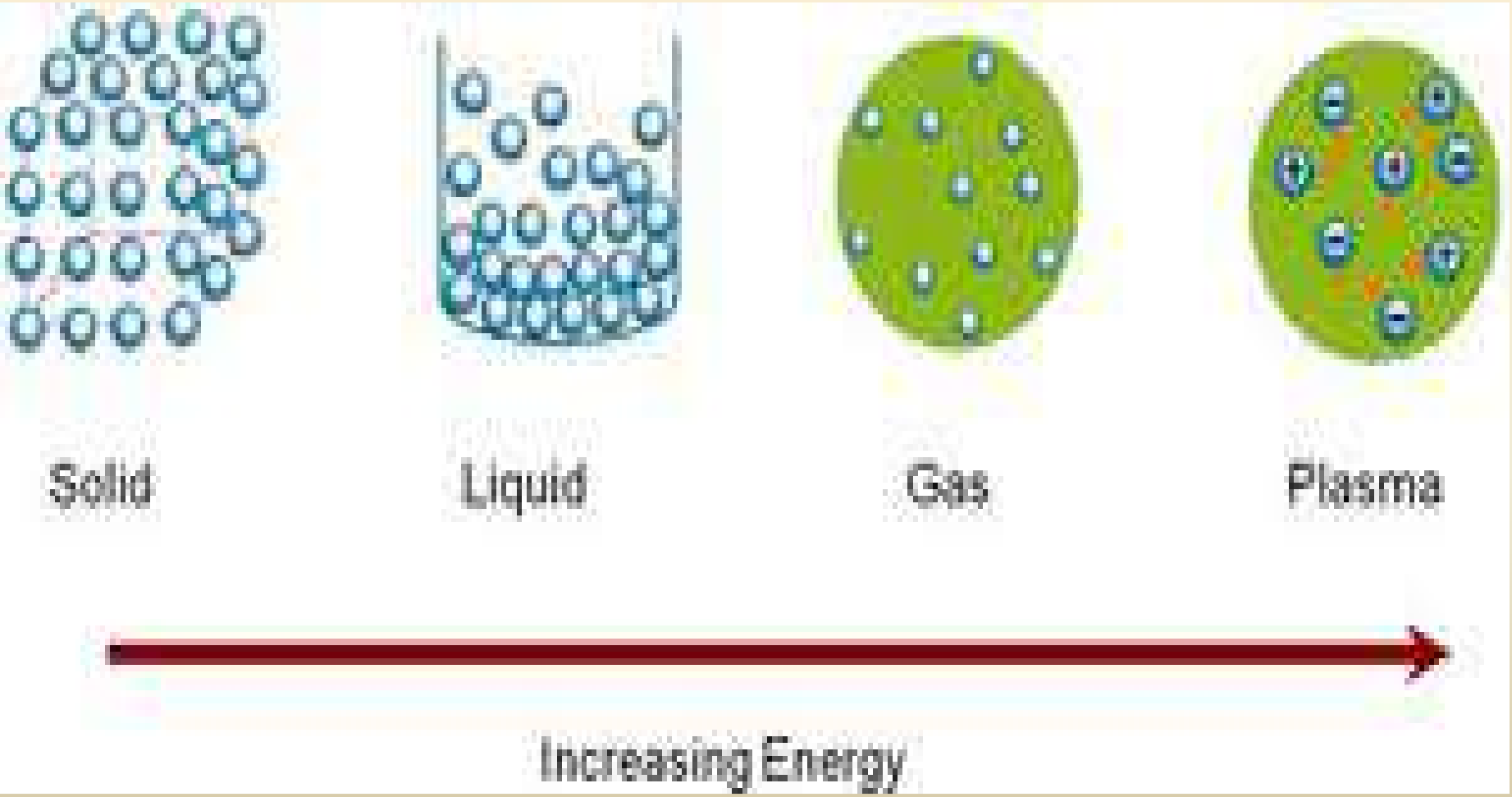
D. Explaining the Behavior of Liquids

- The particles in a liquid are more closely packed than the particles in a gas
- The attractions between the particles in a liquid DO affect the movement of the particles
- **A liquid takes the shape of its container because the particles in a liquid can flow to new locations.**
- **The volume of a liquid is constant because forces of attraction keep the particles close together.**

E. Explaining the Behavior of Solids

- **Solids have a definite volume and shape because particles in a solid vibrate around fixed locations**
- Vibration is a repetitive back and forth motion
- Each atom vibrates around its location but it does not exchange places with a neighboring atom
-

4 States of Matter



4 States of Matter

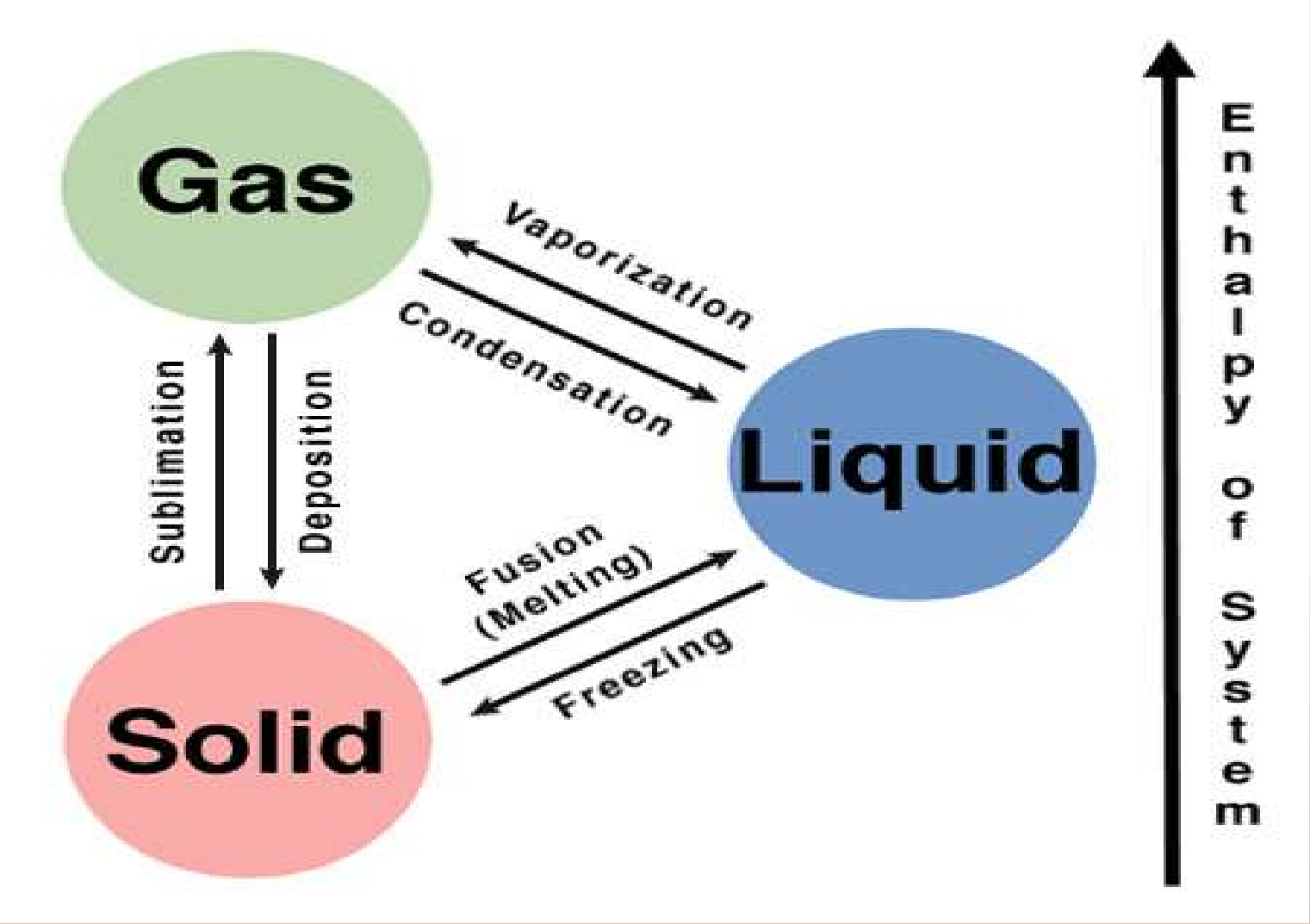
States of matter	**Shape**	**Volume**
Solid	Definite	Definite
Liquid	Indefinite	Definite
Gas	Indefinite	Indefinite

Reading Data Table

Substance	Melting Point	Boiling Point
Rubbing Alcohol	- 89 °C	82.5 °C
Salt	801 °C	1413 °C
Water	0 °C	100 °C
Baking soda	50 °C	851 °C

1. What phase of matter is alcohol in at 0 °C?
2. What phase of matter is Salt in at 900 °C?
3. What substances are a gas at 110 °C?
4. What is the freezing point of baking soda?
5. At what temperature is salt a gas?
6. At what temperature range is baking soda a liquid?

3.3 Phase Change



A. Characteristics of Phase changes

- Phase change is the reversible physical change that occurs when a substance changes form one state of matter to another
- **Melting, freezing, vaporization, condensation, sublimation, and deposition are six common phase changes**
- All phase changes share certain characteristics related to energy and temperature

B. Temperature and Phases Changes

- One way to recognize a phase change is by measuring the temperature of the substances as it is heated or cooled
- **The temperature of a substance does not change during a phase change**
- **TEMPERATURE remains constant during a phase change**

1. Energy and Phase Changes

- During a phase change, energy is transferred between a substance and its surroundings
- **Energy is either absorbed or released during a phase change**
- Endothermic change the system absorbs energy from its surroundings
- Exothermic change the system releases energy to its surroundings

1. Melting

- Melting is when energy is added to a solid object and it turns into a liquid.
- The average kinetic energy of the molecules increase and the temperature rises
- This is ENDOTHERMIC

2. Freezing

- Freezing is when energy is removed form an object and it goes form a liquid to a solid.
- As the average kinetic energy decreases, the molecule move more slowly
- This is EXOTHERMIC

1. Vaporization (Boiling)

- Vaporization (Boiling) is when a substance changes form a liquid into a gas
- Vaporization is an endothermic process, the substance has to absorb energy to change from a liquid to a gas
- As the temperature increases the molecules move faster and faster
- This is ENDOTHERMIC

2. Condensation

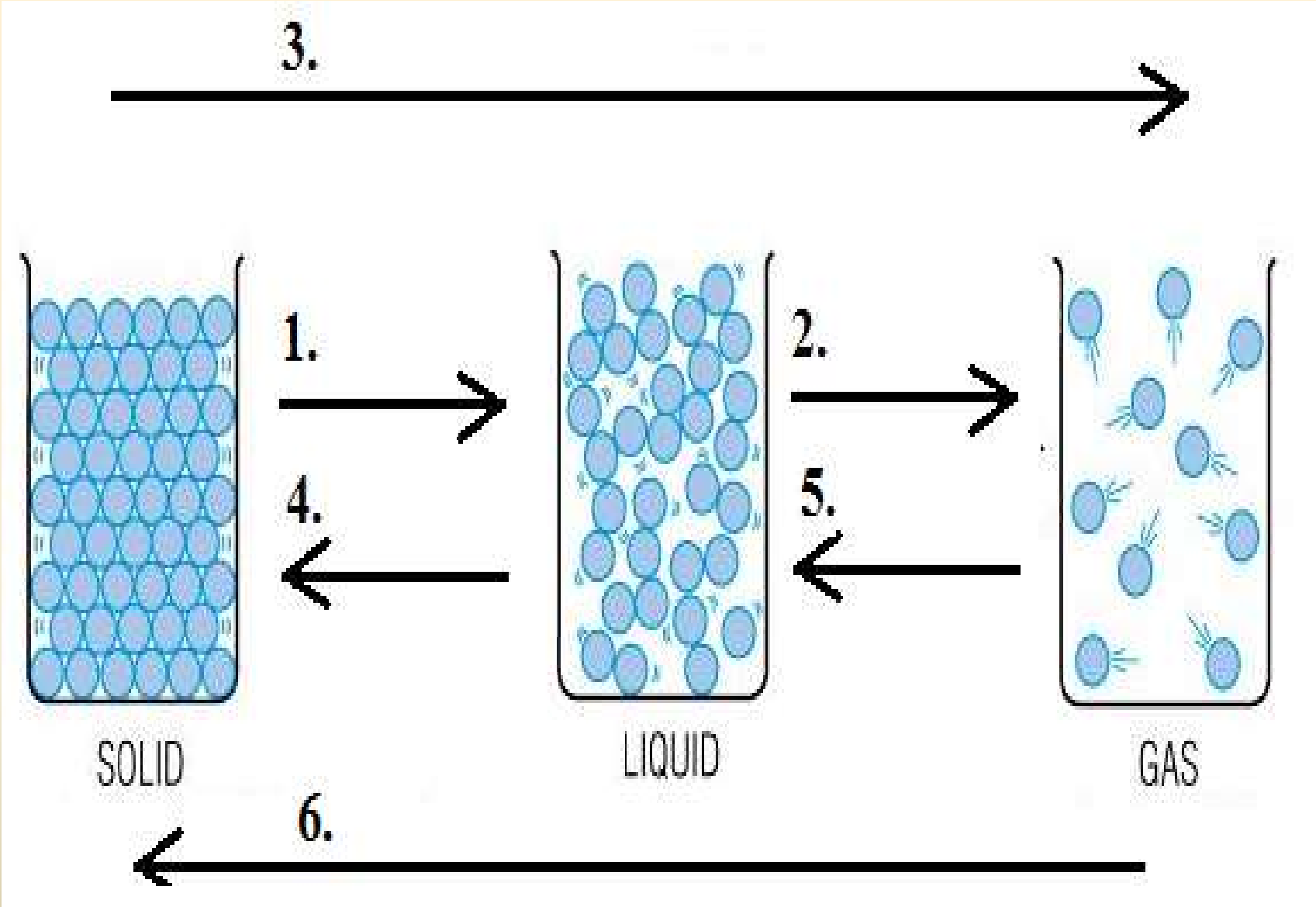
- Condensation is the phase change in which a substance changes from a gas or vapor to a liquid
- Condensation is an EXEOTHERMIC process

Sublimation

- Sublimation is the phase change in which a substance changes form a solid to a gas or vapor without changing to a liquid first
- Dry Ice (solid carbon dioxide) at room temperature goes from solid to gas and forms a "fog"
- Sublimation is ENDOTHERMIC

Deposition

- Deposition is when a gas or vapor changes directly into a solid without first changing to a liquid
- Deposition causes frost to form on windows
- This is EXOTHERMIC


3.
1.
2.
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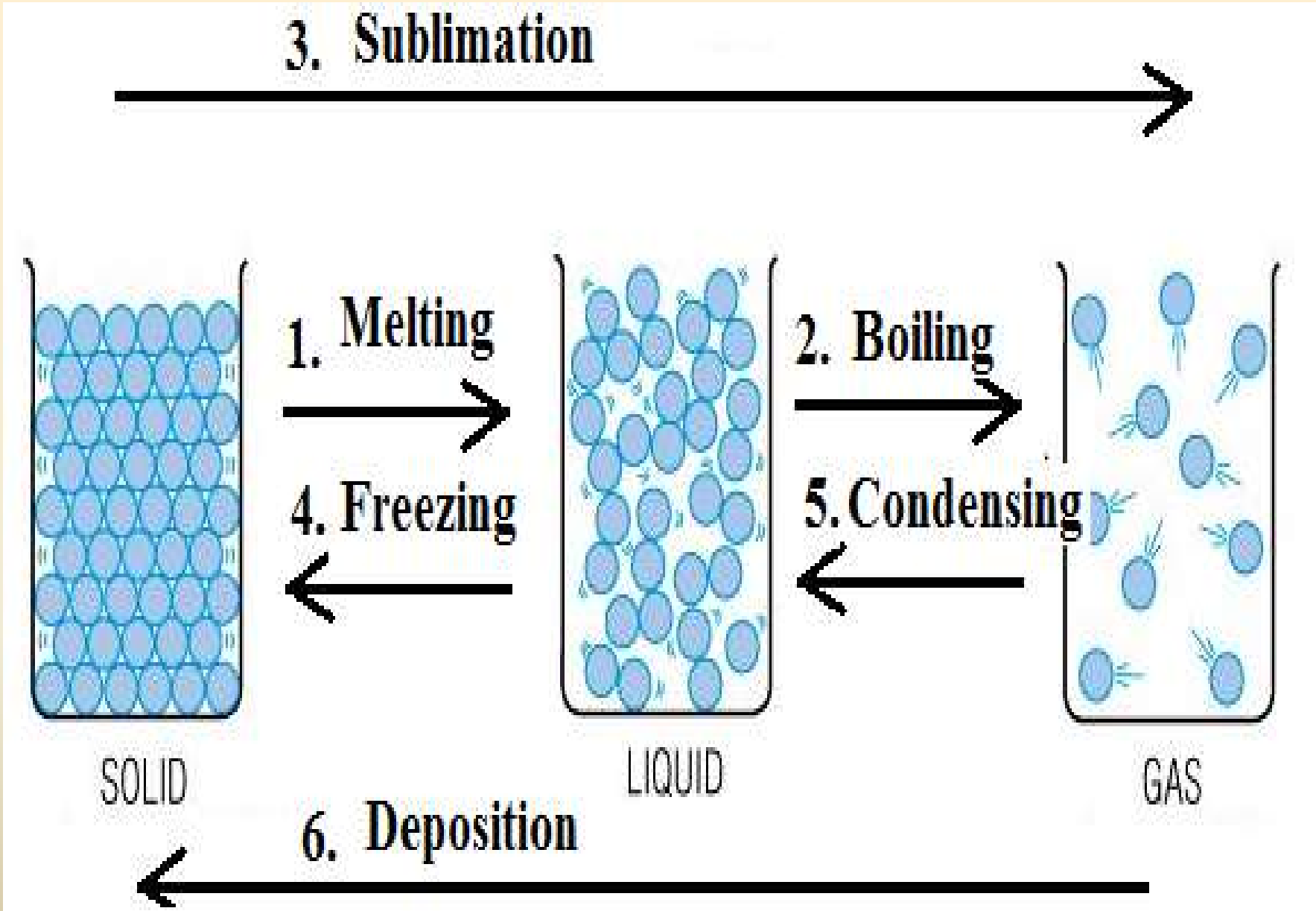
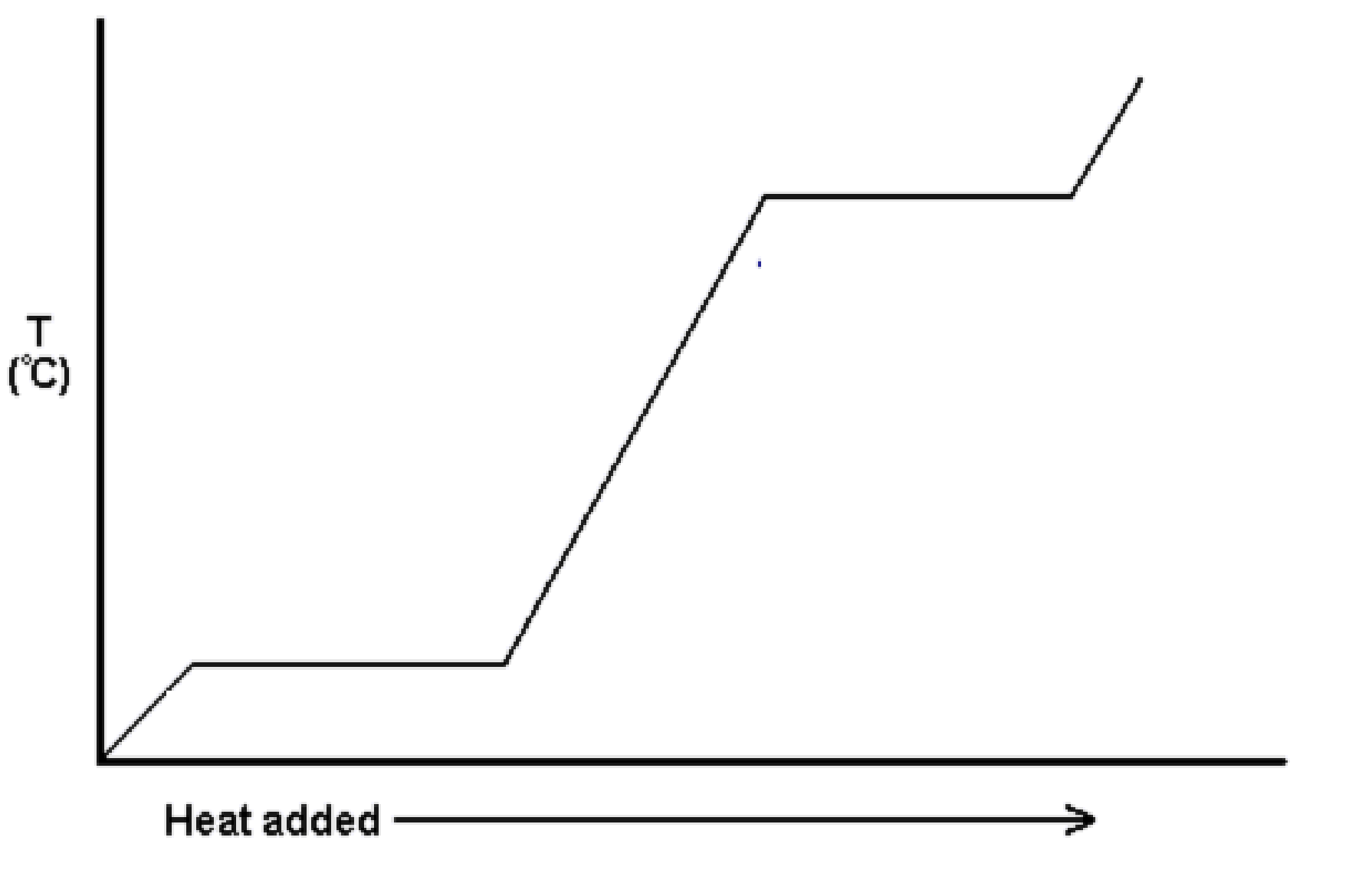
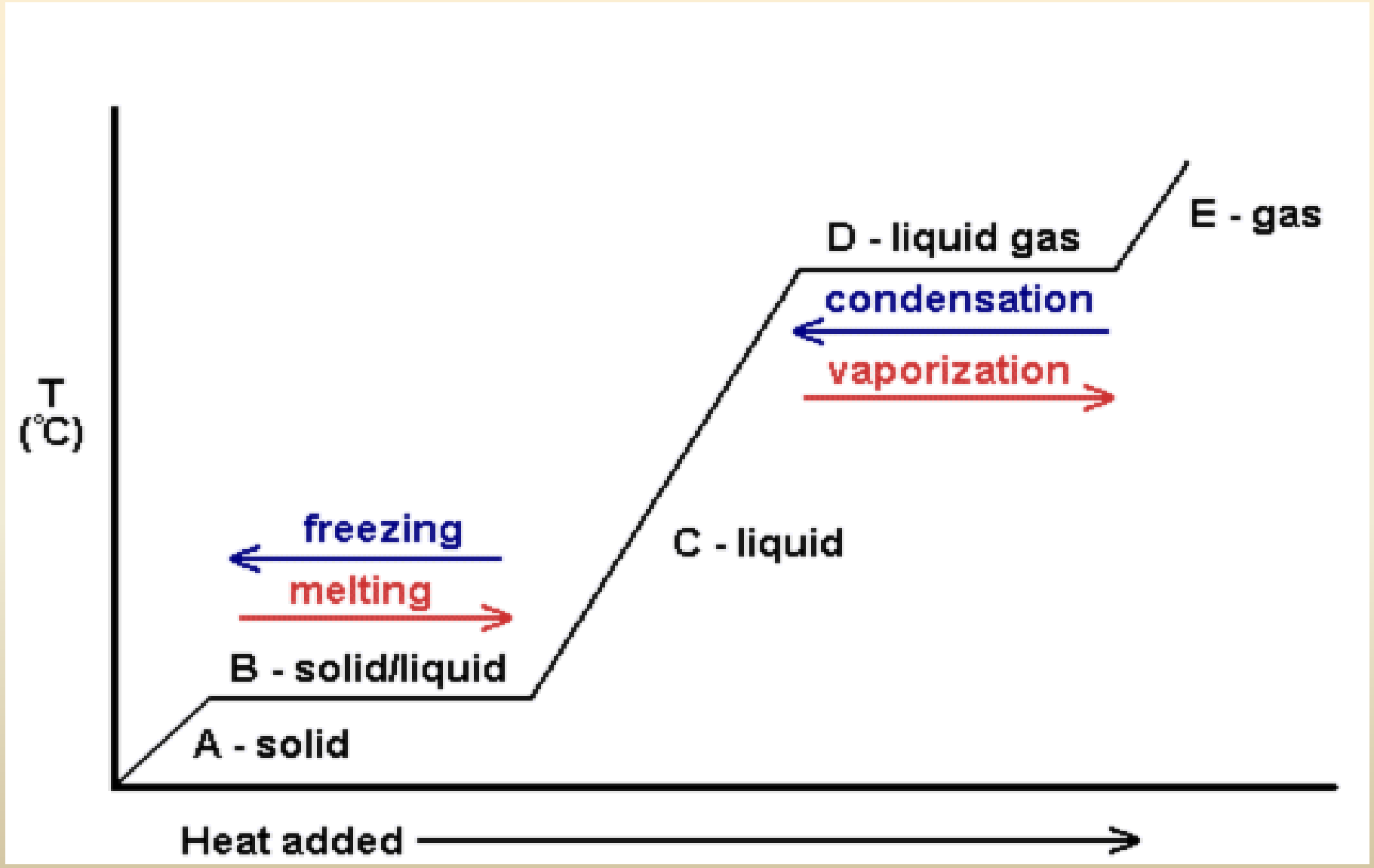
5.
SOLID
LIQUID
GAS
6.


3. Sublimation
1. Melting
2. Boiling
4. Freezing
5. Condensing
SOLID
LIQUID
GAS
6. Deposition

Phase Change Diagram Combined



Phase Change Diagram Combined



Phase Change Diagram Practice

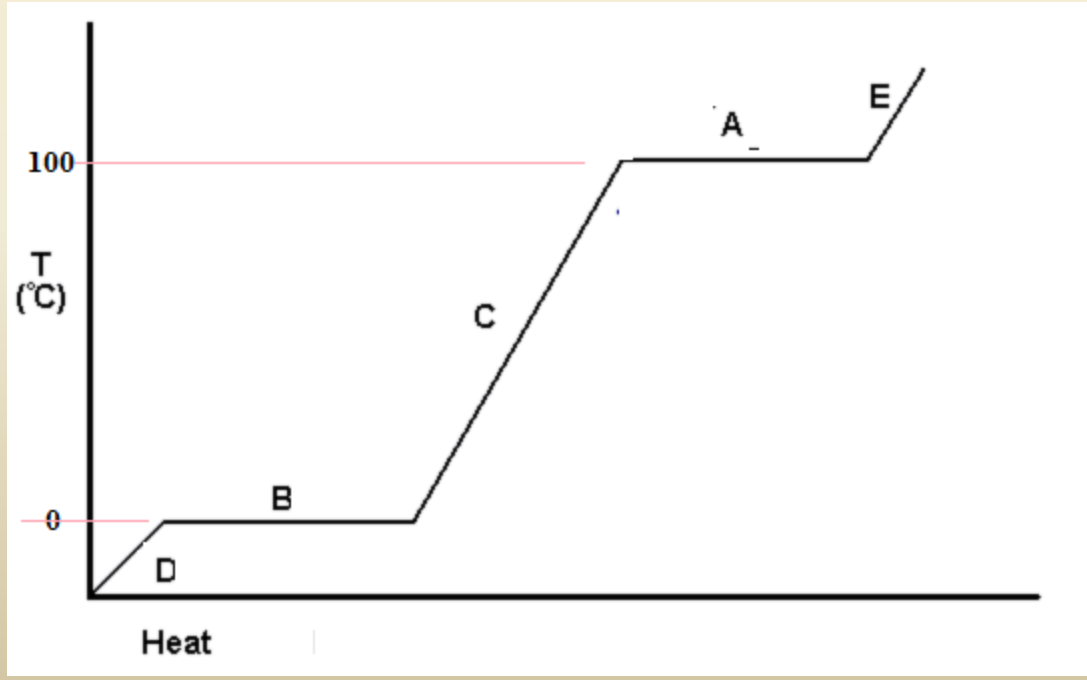
- What is occurring at the following points

A Object is vaporizing or condensing

B Object is melting or freezing

- What phase is present at the following points

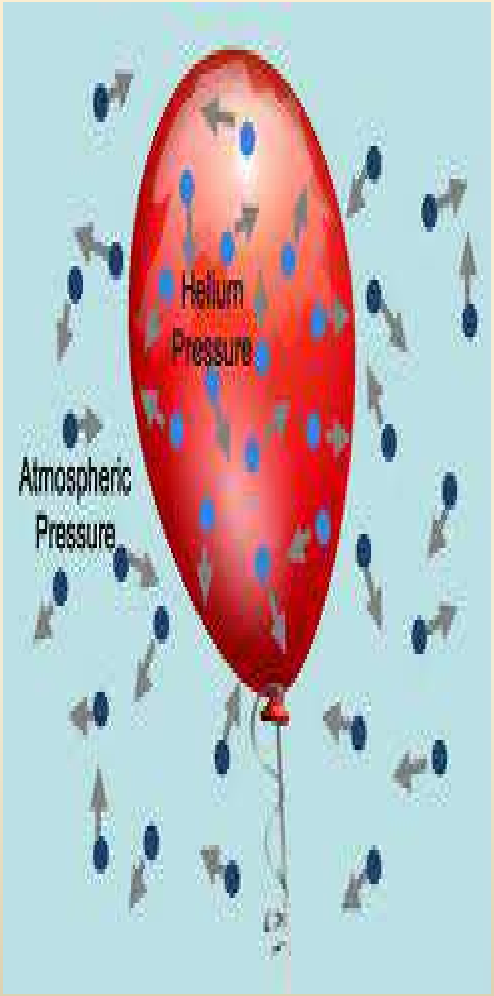
A. Liquid & Gas
B. Solid & Liquid
C. Liquid ONLY
D. Solid ONLY
E. Gas ONLY



3.2 The Gas Laws

A. Pressure

- Pressure is the result of a force distributed over an area
- Pressure is a gas is produced by the gas atoms colliding with a wall
- **Collisions between particles of a gas and the walls of the container cause the pressure in a closed container of gas**
- The more frequent the collisions the greater the pressure of the gas



B. Factors that Affect Gas Pressure

- **Factors that affect the pressure of an enclosed gas are its temperature, its volume, and the number of its particles.**

1. Temperature

- As the temperature rises, the average kinetic energy of the particles in the air increases
- The particles move faster and collide more often.
- **Raising the temperature of a gas will increase its pressure if the volume of the gas and the number of particles are constant**

B. Factors that Affect Gas Pressure

2. Volume

- **Reducing the volume of a gas increases its pressure if the temperature of the gas and the number of particles are constant**

3. Number of Particles

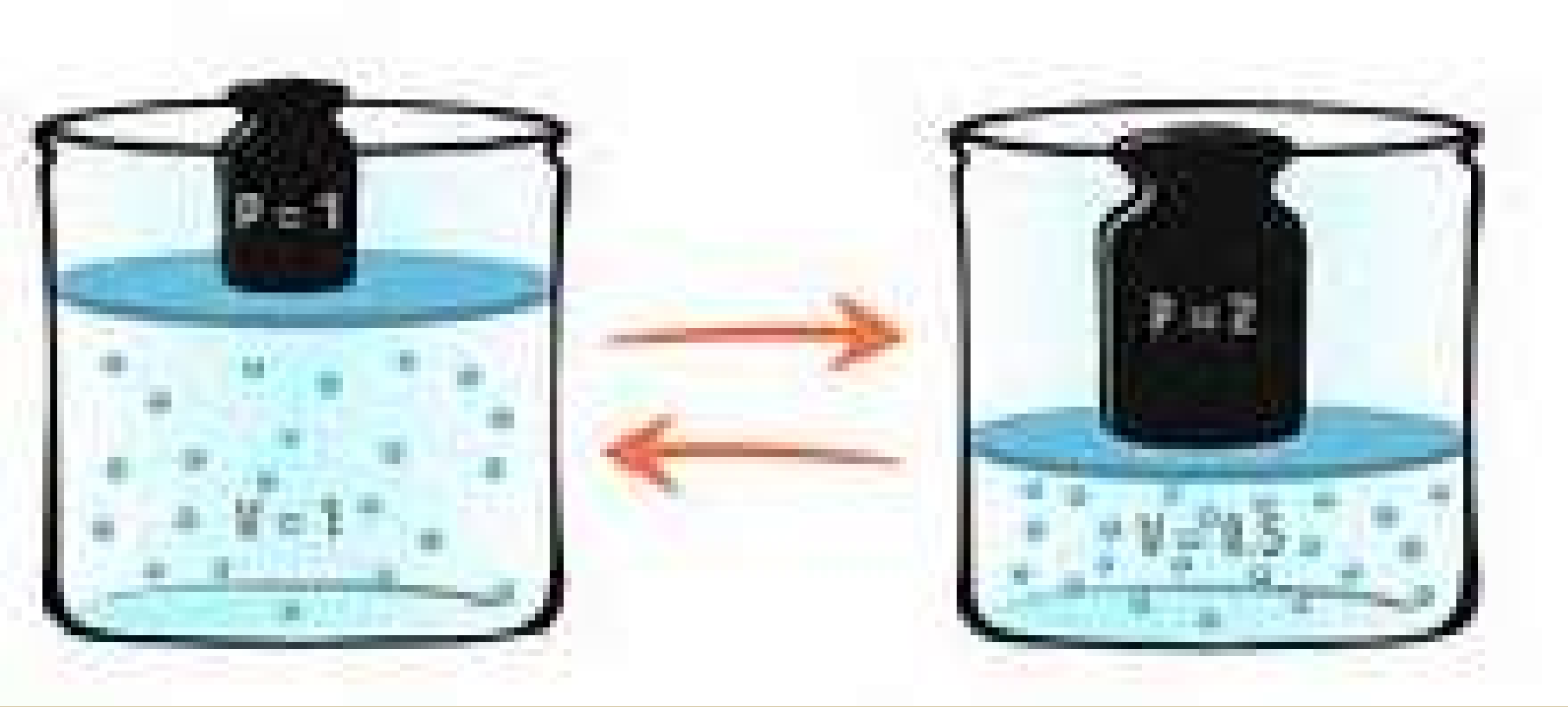
- The more particles there are in the same volume, the greater the number of collisions and the greater the pressure
- **Increasing the number of particles will increase the pressure of a gas if the temperature and the volume are constant**

C. Charles's Law

- Jacques Charles showed that as the volume of a gas increases at the same rate as the temperature of the gas
- Charles's Law states that the volume of a gas is directly proportional to its temperature in Kelvins if the **pressure is constant**

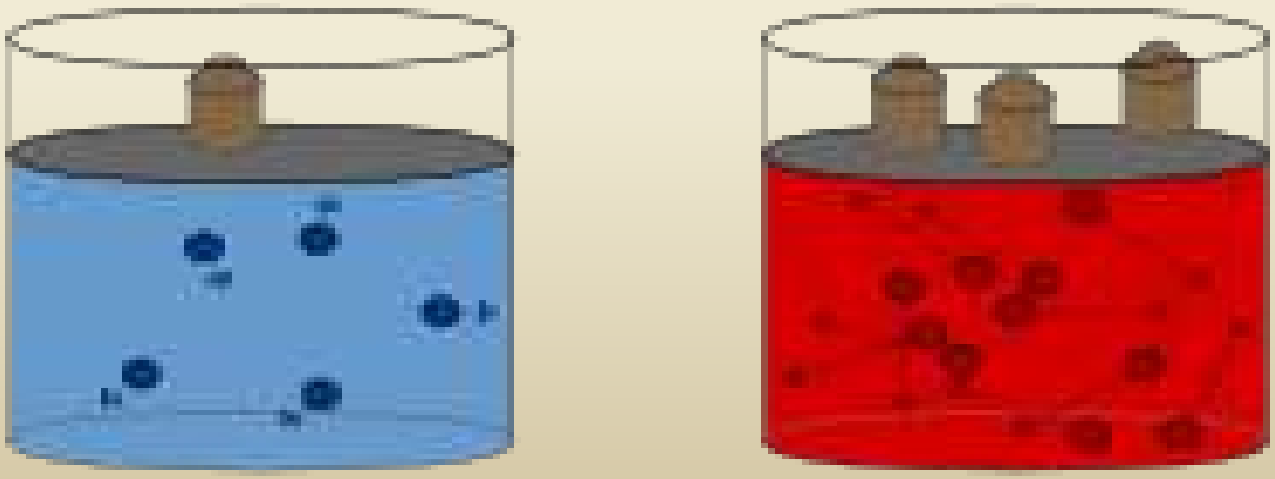
D. Boyle's Law

- Boyle's law states that the volume of a gas is inversely proportional to its pressure if the **temperature is constant**



E. Gay-Lussac's Law

- According to **Gay-Lussac's law**, for a given amount of gas held at **constant volume**, the pressure is proportional to the temperature
- If one increases the other will increase



Gas Laws Card

P	T	V
Pressure	temperature	volume
Charles	Boyles	Gay-Lussac

Gas Law Practice

- Pressure is constant:
  - If temperature increases volume increases
  - If temperature decreased volume decreases
- Temperature is constant:
  - If pressure increases volume decrease
  - If pressure decreases volume increases
- Volume is constant:
  - If the temperature decreases pressure decrease
  - If the temperature increases pressure increases